

# Panama Canal Shutdown or Screwworms Dujor

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# **SCREWWORM CONTAINMENT IN PANAMA DURING FINAL MILITARY WITHDRAWAL**

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## **INTRODUCTION**

Screwworm is a devastating parasitic disease that has long been a leading cause of livestock losses in temperate areas of the Western Hemisphere. The larvae of the Screwworm fly, *Cochliomyia hominivorax*, feed on open wounds of warm-blooded animals, including man. Unlike ordinary maggots that subsist on debris and dead tissue, the Screwworm larvae attack living flesh, causing debilitation and sometimes-even death. A unique biological control program was used to eradicate Screwworm from the United States and neighboring countries. Since 1966 the US Department of Agriculture (USDA) has managed Screwworm as a Foreign Animal Disease (FAD) with a surveillance program to prevent its re-establishment in the US. After more than 30 years of cooperative effort between the USDA and individual Central American countries, the eradication program proceeded as far south as Panama. Despite this success, Screwworm still periodically re-enters the United States with animals arriving from endemic countries to the south. The latest incident involving military members occurred in November 1997 when a pet harboring the parasite came to the US from Panama with a returning service member. Fortunately, early recognition of the problem prevented a serious outbreak and saved the considerable expenses of a quarantine and the renewal of the eradication efforts in the US. In the spring and summer of 1999, the Department of Defense (DoD) began final withdrawal of its personnel from Panama in compliance with the 1977 Carter-Torrijos Panama Canal Treaty. It was estimated that this exodus of nearly 5,000 DoD personnel would include more than 2,500 family pets. US Army Veterinary Corps Officers assigned to the Panama District Veterinary Command (PDVC) worked in close cooperation with the USDA and the Panamanian Ministry of Agriculture to mount an intensive effort to contain endemic Screwworm to Panama and to minimize the threat of Screwworm re-introduction to the U.S. during this large influx of returning pets.

## **SCREWWORM - BIOLOGY AND ERADICATION PROGRAM**

The Screwworm is a larval maggot, the developmental stage of a fly that hatches from eggs laid near a wound. Larvae must feed on live tissue in order to develop further and complete the parasitic life cycle. Debilitation and death ensues when successive Screwworm hatches release thousands of larvae that excavate and greatly enlarge a wound. Surprisingly, the larval feeding does not seem to be painful to the host and even the accompanying tissue inflammation is minimal.

Larvae feed in a wound for five to seven days before maturing to pupae. Screwworm pupae fall to the ground and burrow into the soil where development to adulthood takes another eight days. Within two days of emergence from the soil the adult fly reaches sexual maturity. Thus, an entire life cycle from egg to adult can occur in less than three weeks. Livestock and wildlife are most frequently affected, but Screwworm infestation of pet animals also regularly occurs. Pets that are kept outdoors understandably have a greater risk of exposure to Screwworm than house-pets. Screwworm eggs hatch quickly, usually within 12 hours, so fresh wounds must be rapidly detected and immediately treated with organophosphate insecticides to kill Screwworm larvae.

A highly successful eradication program has effectively eliminated the parasite from most of North America. The eradication program takes advantage of a unique feature of the mating routine of the female Screwworm fly: she mates only once during her entire lifetime, while males mate as many as 10 times. Researchers knew that if enough wild females mated with sterilized males, the Screwworm population could be rapidly eliminated. During a test release, irradiated sterile flies successfully eradicated Screwworm from Curacao, a small island in the Dutch Indies near Venezuela. Building on this success, the USDA developed fly rearing techniques and began large-scale production and dispersion of sterile flies from airplanes. These efforts led to the eradication of Screwworm from the United States.

Despite eradication of Screwworm in the US, the frequent re-introduction of the fly from the Mexican side of the 2000-mile long international border prevented the permanent exclusion of the pest from US soil. It soon became obvious that it would be necessary for the USDA to work cooperatively with Mexico and her southern neighbors to help them in eliminating the fly in order to keep the US

Screwworm-free. The USDA's Animal and Plant Health Inspection Service initiated and continues to sustain a series of cooperative eradication programs that have systematically eliminated Screwworm from most of Central America over the last three decades. In late 1998 the USDA and Panama began the final phase of the Screwworm eradication program in that southern-most Central American country. Because there is no Screwworm control plan for South America, sterile fly release across eastern Panama will continue to be necessary even after Panama becomes Screwworm-free. The sterile flies will create and maintain a biological barrier in Panama's Darien Gap, halting the pest's northward migration at the Panama-Columbia border. In addition to South America, Screwworm also remains endemic on a few islands in the Caribbean (principally Hispanola, and Cuba).

#### **SCREWWORM THREAT REDUCTION IN PANAMA – SPRING & SUMMER 1999**

Even though the USDA's Screwworm eradication program had reached Panama by late 1998, complete eradication would take at least two more years – too late to eliminate the possibility of Screwworm in pets departing with DoD personnel in the spring and summer of 1999. Keeping Screwworm out of the US hinged upon detecting and eliminating the parasite in pets in Panama prior to their departure for the US. In recent years the Army Veterinary Treatment Facility (VTF) located on the Pacific side of the Isthmus of Panama at Ft. Clayton had routinely treated as many as 20 pets per month for Screwworm during Panama's wet season, May through December. With the upcoming mass exodus of people and pets out of Panama it seemed likely that extraordinary precautions would be necessary to keep Screwworm from again reentering the US.

A plan was developed to intensify Screwworm surveillance of departing pets in Panama. Panamanian and U.S. law requires that animals undergo an examination for issuance of a Health Certificate prior to travel. Additionally, a Panamanian export certificate is also required for customs clearance. Because Health Certificates are valid for up to 10 days after the date of issue, there is ample time for a pet cleared to leave Panama to become infested with Screwworm between its examination and departure dates. In fact, the short 12-hour period from egg laying to larval hatch means that a pet with an open wound could become infested with Screwworm right up to the time of departure from Panama. It would be necessary to close the 10-day gap between the Health Certificate examination and departure to improve Screwworm surveillance during DoD's withdrawal. Because final examination of pets on the day of departure at the air terminal proved impractical, a compromise plan provided for a second Screwworm check of pets at the owner's home or hotel room within 48 hours of their departure. At this second exam, owners would be given their departure documents and receive information on the signs and symptoms of Screwworm. They would also learn how to contact military and federal authorities for help should they suspect Screwworm in their pets following the final exam. During the health certificate examination, departing pets also received a subcutaneous injection of Ivermectin at a rate of 300 ug/kg of body weight as a larvicide. Collie type dogs were exempt from this requirement because of their hypersensitivity to Ivermectin.

The next step in the overall prevention plan required the informed participation of veterinary and agricultural regulatory officials from both the US and Panama. At the March 1999 US Army Veterinary Command (VETCOM) Military Veterinary Symposium, a portion of the poster session and a lecture/discussion segment was devoted to informing all Veterinary Corps Officers (VCOs) of the plan to minimize the impending Screwworm threat from Panama. Private veterinary practitioners in the US were also alerted to the Screwworm threat by an article in the March 1<sup>st</sup> issue of the Journal of the American Veterinary Medical Association. Finally in April, a specially produced Army Training video was distributed to state and federal regulatory veterinarians informing them of the plan for Screwworm prevention in pets leaving Panama during the summer of 1999.

Additionally, an agreement was completed between VETCOM (representing DoD) and the USDA establishing procedures that would permit the transport of recently infested pets to the US after they had been cleared of Screwworm in Panama. Previously, Screwworm infested pets were denied exit from Panama and were held in quarantine until their wounds healed. The new procedure permitted travel after anti-larval treatment was completed in Panama. Complete healing of the wound was not required for transport. Instead the plan mandated a confirmatory follow-up examination of the pet within five days of arrival in the US to verify the pet's Screwworm-free status.

In order to handle the increased workload that the plan placed on the PDVC in Panama, a request was approved for additional veterinary resources from US Army Forces Command (FORSCOM). The 94<sup>th</sup> Medical Detachment (Veterinary Medicine), a veterinary field unit was tasked to deploy in May 99 to set up a satellite VTF on the west bank of the Panama Canal to provide an additional pet examination and outprocessing center during peak months of the withdrawal. The unit provided the added capacity that made it possible to thoroughly and rapidly process outgoing pets.

## **RESULTS**

PDVC personnel began heightened surveillance in January 1999 and the requests for health certificates rose sharply starting in March—slightly earlier than predicted. Between January and July 1999, 1363 health certificates were issued (195 per month average), as compared to 563 (80 per month average) during the same time period in 1998. With a 243 per cent increase, the chances of seeing screwworm cases was no doubt higher as well. However, veterinary personnel were beginning to see improvement in the local fly population as the release program moved into the canal area. During the same time period in 1999, there were 23 screwworm cases confirmed by veterinary personnel compared to 35 cases in 1998. However, as projected by DoD personnel, ten of those 23 cases in 1999 occurred in June as rainy season began and the withdrawal was in full gear.

Fortunately for veterinary personnel in Panama and the U.S., only one dog was identified that was infested at the time a health certificate was needed. The animal was immediately hospitalized and treatment begun. Simultaneously, DoD and USDA authorities in the U.S. were notified and tentative travel plans were made. Once the infestation was cleared in Panama, the animal was granted conditional entry into the U.S., pending examination of the remaining wound upon arrival. The wound was examined by AVIC personnel in Atlanta and released to the owner. No further follow-up was deemed necessary.

## **DISCUSSION**

In endemic areas Screwworm infestation is usually a straightforward diagnosis made by simple observation of the maturing larvae (from 1-2 mm to 15 mm in length) in a wound. But when larvae are barely visible shortly after hatching, even experienced personnel can easily overlook them. In addition to such obscure presentations, other systemic difficulties in the Screwworm surveillance program were uncovered when a case of Screwworm was reported from Texas in late November 1997. In that case, Screwworm was discovered in a dog in San Antonio three days after its arrival with a military service member from Panama. The pet had undergone a routine health certificate exam in Panama only three days before its departure. Once in Texas, the dog's owner consulted a private veterinary practitioner when the dog showed signs of lameness (now six days since its Health Certificate examination in Panama). Screwworm was found in a small wound of the paw. In this case, Screwworm was probably present, albeit in a very early stage of development, and was inadvertently overlooked when the dog was examined in Panama. Even so, at the second line of defense, USDA inspectors also had the chance to detect Screwworm when this dog entered the US port of entry in Miami. Unfortunately, the dog was not even examined in Miami because budget restrictions and other mission priorities do not allow for enough veterinary inspectors to check each and every pet animal upon arrival in the US. In this case only the concern of the owner and a thorough examination led to a diagnosis. This case history highlights the all-important role that private veterinary practitioners have in the diagnosis of Screwworm and other foreign animal diseases when routine surveillance procedures fail. The focus on Screwworm biology and identification in veterinary parasitology courses in the US Veterinary Colleges has no doubt lessened over the three decades since eradication. Thus, the recognition of Screwworm by younger veterinarians as occurred in this case becomes less likely as our more experienced practitioners retire.

Preventive treatment of animals prior to transport was pursued as a way to provide protection against the parasite in occult infestations or when wounds occur after the final exam. Drugs are available that promise to prevent survival and maturation of invading Screwworm larvae for up to 14 days. Recent research done in cattle and sheep had shown that Doramectin, a member of the avermectins, (a group of broad spectrum anti-parasitic drugs) shows efficacy in killing early stage Screwworm larvae. No efficacy or safety tests have been done for Doramectin as a Screwworm preventative in dogs or cats. However, an oral formulation of a related drug, Ivermectin, is licensed and widely used in pet animals to prevent Heartworm disease (at a dose of 6 ug/kg). Additionally, although the injectible formulation of Ivermectin is not labeled for use in pets, there is widespread literature documenting its safe extra-label use at much

higher doses than the oral product for control of parasites in dogs and cats. Based on the available safety evidence and Ivermectin's potential efficacy against Screwworm larvae, a decision was made to give pets leaving Panama an injection of Ivermectin at 300 micrograms/kilogram of body weight at the time of Health Certificate exam. Only those animals with a hypersensitivity to Ivermectin (principally Collie-breed dogs) were exempted from this requirement. Although there is no way of assessing the efficacy of this preventive strategy, no untoward drug reactions were noted in any of the pets receiving Ivermectin.

Overall, the Screwworm containment effort was effective in preventing re-entry of the parasite to the US. The deployment to Panama of FORSCOM veterinary personnel specifically devoted to Screwworm containment allowed the intensification of Screwworm surveillance of departing animals. These resources on the ground in Panama insured that every pet was thoroughly checked and then rechecked for Screwworm during the peak of the large influx of pets returning to the US. No doubt the coincidental diminution of the Screwworm flies by the rapid progress of the ongoing USDA-Panama Screwworm Eradication program also contributed substantially to the success of the containment effort.

Additionally, an unrelated circumstance prompted the early return of many pets to CONUS and significantly reduced the number of pets departing during the peak months of the withdrawal. Because of previous problems and liability concerns, it has become common for air carriers to deny transport of pets during the hottest summer months when temperatures regularly exceed 85°F. Many owners elected to ship their pets out of Panama early in the spring to avoid summer travel restrictions imposed by some air carriers.

Historically, the employment of military veterinary assets has provided necessary manpower to assist the USDA in FAD emergencies. Control of Screwworm in animals at the point of origin in Panama rather than at the point of entry in the US appeared to be the most cost-effective prevention option available. Employment of this strategy allowed the USDA to maintain its selective screening of imported animals at all US ports of entry rather than assigning additional resources to specific ports to cover the intermittent arrival of pets from Panama. The timely application of adequate resources in Panama from May through August 1999 in a coordinated proactive plan also saved the cost of controlling a Screwworm outbreak in the US. Expected costs for eliminating an outbreak include those related to the investigation and quarantine of suspect cases and the subsequent costs of eradication (sterile fly release flights). Estimates quickly exceed a million dollars for eradication of even a very small focus.

Cooperation between US Army Veterinarians and the USDA is in concert with national disaster planning related to FADs. The timely deployment of the 94<sup>th</sup> Medical Detachment (Veterinary Medicine) to Panama for Screwworm containment further strengthened the relationship between the military and the USDA. Veterinary TO&E units such as the 94<sup>th</sup> Med Det train specifically to execute these types of missions. A growing number of VCOs have also received specialized training in FAD recognition at the FAD Diagnosticians course held at the USDA's biological containment facilities at Plum Island New York.

## **CONCLUSION**

A coordinated cooperative effort among multiple agencies from both the US and Panama, averted a potentially disastrous Screwworm outbreak in the US associated with the DoD withdrawal from Panama during the summer of 1999. This successful operation emphasizes the added value of timely planning, increased awareness and close coordination between US Army Veterinarians and the USDA in protecting the US against future FAD outbreaks.